Base Realignment and Closure
Program Management Office West
San Diego, California

Draft Final

Parcel G Removal Site Evaluation Work Plan

Former Hunters Point Naval Shipyard
San Francisco, California

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MARSSIM Section 5.5.2.2 defines the method for calculating the number of soil samples when residual radioactivity is uniformly present throughout an SU. Therefore, determining the number of samples will be based on the following factors:

- RG for radioactivity in soil (upper boundary of the gray region [UBGR])
- Lower boundary of the gray region (LBGR)
- Estimate of variability (standard deviation [σ]) in the reference area and the SUs
- Shift (Δ=UBGR-LBGR)
- Relative shift ([UBGR-LBGR]/σ) (see **Equation 3-1**)
- Decision error rates for making a Type I or Type II decision error that the mean or median concentration exceeds the RG (determined via MARSSIM Table 5.2)

Each of the preceding factors is addressed in the following paragraphs. Example data are provided to assist in explaining the process for calculating the minimum sample frequency. Actual numbers of samples for SUs will be based on reference area data once they become available. The data quality assessment (DQA) of SU data will include a retrospective power curve (based on the MARSSIM Appendix I guidance) to demonstrate that a sufficient number of samples was collected to meet the project objectives.

The ^{226}Ra RG is defined as 1 pCi/g plus background. As a basis for the calculations, the background ^{226}Ra soil concentration is assumed to be 1 pCi/g.

MARSSIM defines a gray region as the range of values in which the consequences of decision error on whether the ^{226}Ra concentration is less than or exceeds the RG are relatively minor. The RG of 1 pCi/g of ^{226}Ra above background (1 pCi/g) was selected to represent the UBGR (2 pCi/g). The LBGR is the median concentration in the SU, and the retrospective power will be determined after the survey is completed. Given the absence of data prior to performing the investigation activities, MARSSIM Section 2.5.4 suggests arbitrarily selecting the LBGR as half the RG. Therefore, for this example, the LBGR = 0.5 pCi/g + 1 pCi/g = 1.5 pCi/g. Assuming the UBGR equals the RG, then Δ = 0.5 pCi/g for this example.

MARSSIM defines σ as an estimate of the standard deviation of the measured values in the SU. Because SU data will not be available until the investigation activities are completed, MARSSIM recommends using the standard deviation of the RBA as an estimate of σ. Given the absence of data prior to performing the investigation activities, an arbitrary value of 0.25 pCi/g has been selected as an estimate of σ for this example.

The relative shift is calculated based on MARSSIM guidance (Section 5.5.2.2) as shown in the following equation:

Equation 3-1

$$\frac{\Delta}{\sigma} = \frac{(UBGR - LBGR)}{\sigma} = \frac{(RG - LBGR)}{\sigma} = \frac{(2.0-1.5)}{0.25} = 2.0$$

The minimum number of samples assumes the ^{226}Ra concentration in the SU exceeds the RG. Type I decision error is deciding that the ^{226}Ra concentration in the SU is less than the RG when it actually exceeds the RG. To minimize the potential for releasing soil with concentrations above the RG, the Type I decision error rate is set at 0.01. Type II decision error is deciding that the ^{226}Ra concentration exceeds the RG when it is actually less than the RG. To protect against remediating soil with concentrations below the RG, the Type II decision error rate is set at 0.05.

MARSSIM Table 5.3 lists the minimum number of samples to be collected in each SU and RBA based on the relative shift and decision error rates. For a relative shift of 2, with a Type I decision error rate of 0.01 and Type II decision error rate of 0.05, MARSSIM Table 5.3 recommends a minimum of 18 samples

in each SU and RBA. For example, for Phase 1, a minimum of 18 samples would be collected for every 152 cubic meters (m^3) of soil (calculation provided in **Section 3.4.4.2**).

Therefore, 18 samples are recommended as a placeholder until data from the RBA study become available. The minimum number of samples per SU will be developed based on the variability observed in the RBA data. A retrospective power curve will be prepared to demonstrate that the number of samples from each SU was sufficient to meet the project objectives. If necessary, additional samples may be collected to comply with the project objectives.

3.4.2 Locating Samples

Systematic soil samples will be located using Visual Sample Plan (VSP) software (or equivalent). Each TU or SU will be mapped in VSP, such that at a minimum, 18 systematic soil samples will be collected in each TU or SU. The systematic soil samples will be plotted using a random start triangular grid using the VSP software with GPS coordinates for each systematic sample.

3.4.3 Radiological Background

The RGs presented in **Table 3-5** are incremental concentrations above background; therefore, RBA samples and measurements will be collected and evaluated to provide generally representative data sets estimating natural background and fallout levels of man-made radionuclides for the majority of soils at HPNS. The RBA characterization will incorporate three survey techniques: gamma scans, surface soil sampling, and subsurface soil sampling to support data evaluations. The details on soil locations, surveying, sampling, and data evaluation are presented in the Soil RBA Work Plan (**Appendix C**).

3.4.4 Phase 1 Trench Unit Design

Radiological investigations will be conducted on a targeted group of 21 of the 63 TUs associated with former sanitary sewer and storm drain lines (**Figure 3-1**). The former TUs selected for Phase 1 investigation were based on their location adjacent to (downstream/upstream) impacted buildings and considered the recommendations from the Radiological Data Evaluation Findings Report (Navy, 2017). The name, size, and boundary of the TUs will be based on the previous plans and reports (**Table 3-1**).

The Phase 1 TUs will be re-excavated to the previous excavation limits by making reasonable attempts to ensure accuracy in relocating the former TU boundaries (see **Section 3.6.3**). The excavated soil material will be investigated by gamma scan surveys and systematic and biased soil sample collection following either the automated soil sorting system process (**Section 3.6.3.1**) or the RSY process (**Section 3.6.3.2**). If the investigation results from the gamma scan surveys and results from the analysis of systematic and biased soil samples demonstrate potential exceedances of the RGs and background, the material will be segregated for further evaluation as described in **Section 5.3**.

To address the Phase 1 radiological investigations of the former trench sidewalls and floors, a strategy to not only excavate the former trenches to the previous excavation limits, but to over-excavate at least an additional 6 inches outside the estimated previous boundaries of the sidewalls and bottom will be employed. The exhumed over-excavated material will represent the trench sidewalls and bottom and will be gamma scan-surveyed and sampled ex situ, to provide the following benefits:

- Significant improvement of the measurement quality for gamma scan surveys by controlling the measurement geometry.
  - Material thickness will not exceed 6 inches
  - Use of large-volume sodium iodide (NaI) detectors with shielding
  - Use of large-volume NaI detectors with spectroscopy

Each of the preceding factors is addressed in the following paragraphs. Example data are provided to assist in explaining the process for calculating the minimum static measurement frequency. Actual numbers of static measurements for SUs will be based on reference area data once they become available. When using the unity rule, the RG is defined as 1 (unitless) plus background. As a basis for the calculations, the background surface activity concentration is assumed to be 0.5.

MARSSIM defines a gray region as the range of values in which the consequences of decision error on whether the residual surface activity is less than or exceeds the RG are relatively minor. The RG of 1 above background (0.5) was selected to represent the UBGR (1.5). The LBGR is the median concentration in the SU, and the retrospective power will be determined after the survey is completed. Given the absence of usable data prior to performing the investigation activities, MARSSIM Section 2.5.4 suggests arbitrarily selecting the LBGR as half the RG. Therefore, for this example, the LBGR = 0.5 + 0.5 = 1. Assuming the UBGR equals the RG, then Δ = 1.5 – 1.0 = 0.5 for this example.

MARSSIM defines σ as an estimate of the standard deviation of the measured values in the SU. Because SU data will not be available until the investigation activities are completed, MARSSIM recommends using the standard deviation of the RBA as an estimate of σ. Given the absence of data prior to performing the investigation activities, an arbitrary value of 0.25 has been selected as an estimate of σ for this example.

The relative shift is calculated based on MARSSIM guidance (Section 5.5.2.2) as shown in **Equation 4-1**.

Equation 4-1

$$\frac{\Delta}{\sigma} = \frac{(UBGR - LBGR)}{\sigma} = \frac{(RG - LBGR)}{\sigma} = \frac{(1.5 - 1.0)}{0.25} = 2.0$$

The minimum number of samples assumes the ROC concentration in the SU exceeds the RG. Type I decision error is deciding that the ROC concentration in the SU is less than the RG when it actually exceeds the RG. To minimize the potential for releasing buildings with concentrations above the RG, the Type I decision error rate is set at 0.01. Type II decision error is deciding that the ROC concentration exceeds the RG when it is actually less than the RG. To protect against remediating building surfaces with concentrations below the RG, the Type II decision error rate is set at 0.05 as recommended by MARSSIM.

MARSSIM Table 5.3 lists the minimum number of static measurements to be performed in each SU and RBA based on the relative shift and decision error rates. For a relative shift of 2, a Type I decision error rate at 0.01, and Type II decision error rate of 0.05, MARSSIM Table 5.3 recommends a minimum of 18 static measurements in each SU and RBA.

Therefore, 18 static measurements are recommended as a placeholder until background data are available. The minimum number of static measurements per SU will be developed based on the variability observed in the RBA data. The DQA of SU data will include a retrospective power curve (based on the MARSSIM Appendix I guidance) to demonstrate that enough static measurements were performed to meet the project objectives. If necessary, additional static measurements may be performed to comply with the project objectives.

4.4.2 Radiological Background

Building 404 will serve as the primary RBA in the investigation of Parcel G buildings (**Figure 4-1**). Building 404 is a non-impacted, unoccupied former supply storehouse constructed in 1943 (see Reference 1598 in NAVSEA, 2004). From the same construction era and with materials similar to those of the impacted Parcel G buildings, Building 404 has 43,695 square feet of concrete floors, a wooden superstructure, prepared roll or composition roof, and drywall offices.

RAO, then the data will be evaluated to determine whether site conditions are protective of human health using USEPA's current guid
Radiation Risk Assessment at CERCLA Sites (USEPA, 2014). A removal site evaluation report will be developed to include recommenda
further action." EPA Directive 9200.4-40 was issued as guidance only and, as such, is not a regulatory requirement or a ROD-establishe
cleanup level for the Hunters Point Naval Shipyard (HPNS) site in accordance with the CERCLA process as promulgated in 40 CFR §300
Parcel G, the ROD has already established cleanup goals that govern the remedy. Please revise these sections of the Work Plan to stat
only areas that are demonstrated to comply with the Parcel G ROD requirements will be eligible for Regulatory Agency approval and r

**ll references to USEPA's current guidance on Radiation Risk Assessment at CERCLA Sites (USEPA, 2014) were removed; however, the N
elieves it is appropriate to consider USEPA's updated guidance. Changes to the cleanup levels are not proposed for this project.**

xecutive Summary and Section 3.4.4, Phase I Trench Unit Investigation: This section states that TUs will be over-excavated (i.e., excavated
he estimated previous boundaries of the sidewalls and bottom), and will be gamma scan surveyed and sampled ex- situ (i.e., on a Radiatio
creening Yard). The Work Plan Tab le 3-1, Phase 1 soil Trench Units indicates that the sidewalls and floor will be combined into one survey
avy's proposal to excavate all soil beyond the previous boundaries will be more protective than EPA's March 2018 proposal because more
aterial will be excavated and tested instead of only systematic samples. In addition, scanning this material ex-situ will give more reliable r
hat scanning in-situ (i.e., in the trench itself). Therefore, EPA agrees with the Navy's alternative proposal to address the potential for conta
remain in the sidewalls and bottom of the trenches. However, please revise the Work Plan to specify that in the event that an exceedanc
ny of the ROD ROC RGs is identified in the ex-situ scanning, the Work Plan should require in-situ investigation, i.e., the sidewalls and floor
ssociated trench be scanned and systematic samples should be collected and analyzed inside the trench to identify where contamination
e present. Furthermore, please revise the Work Plan to specify that the source trench will not be backfilled before confirming if an exceed
ound in excavated material. If an exceedance is found, then the trench will not be backfilled until the in-situ scanning and sampling is done
dentify the location of the exceedance and excavation of contamination is completed.

**able 3-1 has been updated to include the Phase 1 trench units identified by the USEPA (TUs 97, 98, 115, and 121). Table 3-1 has also be
orrected to show the accurate number of expected sidewall and floor units (SFU), based on a maximum soil volume per survey unit of 1**

**ext in the Executive Summary and throughout the work plan has been updated to conduct an in situ investigation of the open excavati
xceedance not attributable to background in an SFU is found, and an in situ investigation and/or remediation will be performed prior t
ackfill. The in situ investigations will require excavations to be open longer and will extend the fieldwork period.**

xecutive Summary and Section 3.4.5, Phase 2 Trench Unit Design: Because the surface of the trench is the location closest to potential res
PA recommends treating the surface over each former trench or su rvey unit as a new soil surface survey unit to be tested using an approa
milar to that used in previous HPNS radiological investigation Work Plans and in MARSSIM. This means that after removing the asphalt an
ther cover material, 100% scanning and systematic sampling should be conducted. The number of cores must be no fewer than the numb
ystematic locations determined from a statistical evaluation consistent with the practices described in MARSSIM. Each core location is cor
be a single systematic sample location, even though multiple depths within the core may be analyzed. In the past, 18 samples has been
efault, but this number should be calculated based on the variability in the data actually collected, which may result in a total number hig
ower than 18. These calculations should use the variability in the sample results obtained from the new background study. Please revise th
lan to specify the number of locations for core sampling locations must be determined as described in EPA's General Comment # 20 in its
018 comments.

**urface scanning of Phase 2 trenches has been added to the Work Plan. The Executive Summary and applicable sections of the text have
evised to reflect the calculation for a minimum number of 18 systematic sample locations for soil and static measurements for b uilding
n assumptions of a relative shift of 2.0, Type I decision error rate at 0.01 and Type II decision error rate of 0.05, MARSSIM Table 5.3
ecommends a minimum of 18 systematic samples for soil and static measurements for buildings in each survey unit. Therefore, 18 syst
ocations for soil and static measurements for buildings are recommended as a placeholder until data from the reference background ar
ecomes available. The minimum number of samples/measurements per survey unit will be developed based on the variability observe
ackground data. A retrospective power curve will be prepared to demonstrate the number of samples from each survey unit was suffic
eet the project objectives. If necessary, additional samples ma y be collected to comply with the project objectives.**

**he Navy agrees that a MARSSIM is the best guidance for designing the radiological investigation. The MARSSIM framework for calc ulat
ppropriate numbers of soil samples and survey measurements was conservatively applied to the Phase 2 TUs in the draft work plan. H
he Navy has incorporated the regulators' sampling proposal to co llect three times as many samples as required in the interest of gainin
oncurrence of the work plan and collecting data as soon as possible.**

**he inputs to the MARSSIM equations are primarily valid for the statistical tests for which they were designed. The Navy therefo re belie
MARSSIM should be used to both design the survey and evaluate the data. However, the Navy has incorporated the USEPA's requireme
oint-by-point comparison in the interest of gaining concurrence of the work plan.**

esponses to EPA General Comments 5, 8, 12a, and 16: The responses appear to indicate that providing a point by point comparison of dat
he Parcel G Record of Decision (ROD) RGs is not as valid as using the MARSSIM WRS test, which compares the medians of the data set and
ackground data set for assessing compliance with cleanup standards. However, the Remedial Action Objective (RAO) for radiologically imp
oil and structures in the Parcel G ROD states, "Prevent exposure to radionuclides of concern in concentrations that exceed remediation go
otentially complete exposure pathways." During all previous removal and remedial actions, this has been implemented as a comparison o